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Training Aids for Basic Combat Skills: A Video Feedback System

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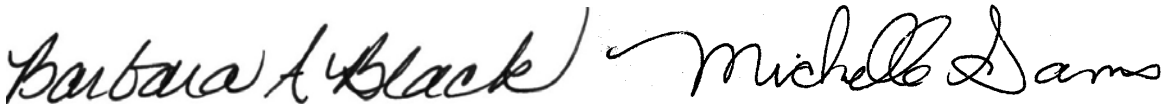

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14. ABSTRACT *(Maximum 200 words)*:

The overarching goal was to develop a training aid that could be used by Initial Entry Training (IET) companies to provide timely performance feedback to Soldiers. Training-aid development followed a five-phase process: Design, Development, Utilization, Assessment, and Revision. The training aid consisted of compact and light-weight cameras and projectors to record and playback training events. Drill Sergeants (DSs) from seven different IET companies recorded activities during over 30 training events. Users stated that the camera was useful for collective training events, but not for some of the desired activities during individual training events. Shortcomings included an inability to zoom-in to see close-up details, no means to playback the video in slow motion, and the requirement for an adequate light source to capture a viewable image. The projector was rarely used. In addition, the most prevalent response from DSs was that the rapid pace of the training schedule and the high Soldier-to-DS ratio made it unrealistic to attempt to provide immediate performance feedback to Soldiers. The video capture and playback system did not meet the purposes of an IET training environment, but the research led to an understanding of future requirements for such a system.

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The authors are grateful to the Drill Sergeants and leaders who explored the possibility of using the feedback training aid components and generously provided input concerning what worked best in the Initial Entry Training environment. These individuals relied on their training experiences to employ the capability in various situations and conditions then offered useful suggestions. They also assessed the potential value of the camera and projector for other training purposes. Their contributions and assistance were instrumental in this research project. The authors thank Dr. Jean Dyer for her comments on earlier drafts of this report and also thank Dr. Ken Evans and Mr. Bill Sanders for their expert review of the report.

TRAINING AIDS FOR BASIC COMBAT SKILLS: A VIDEO FEEDBACK SYSTEM

EXECUTIVE SUMMARY

Research Requirement:

Receiving feedback on performance is an important contributor to learning. Soldiers receive training on a multitude of tasks during Initial Entry Training (IET). Due to the pace of the training environment and high Soldier-to-trainer ratios, Drill Sergeants (DSs) often lack the opportunity to provide timely performance feedback to Soldiers. This research was conducted to explore a training aid that would allow DSs to provide immediate feedback to Soldiers as part of regular training events. Ideally, the feedback could be provided at a time and place when Soldiers could make timely adjustments to their performance.

Procedure:

Compact and lightweight cameras were used by 28 DSs from a total of seven IET companies to record activities during nearly 30 training events. The small viewing screen on the camera and a projector were available to provide performance feedback to Soldiers immediately following the training activity. After use, either weekly or daily, DSs completed a questionnaire that addressed the usefulness of the components, as well as their ease of use.

Findings:

DSs stated that the camera served its intended purpose for all of the collective training events and most of the individual events with a median rating of 7 on a 9-point usefulness scale. DSs stated they could show the Soldiers their errors, which was more useful than merely trying to explain the errors in words. The camera was not very useful for recording some of the activities during individual training events with a median rating of 3. Shortcomings noted by the DSs included an inability to zoom-in to see close-up details, no means to playback the video in slow motion, and the requirement for an adequate light source to capture a viewable image. The projector was rarely used, and when used, it was in a barracks area, not in the field. In addition, the most prevalent response from DSs was that the rapid pace of the training schedule and the high Soldier-to-DS ratio made it unrealistic to attempt to provide immediate performance feedback to Soldiers. Overall, the video capture and playback system did not meet all of the needs of an IET training environment.

Utilization and Dissemination of Findings:

Results of this research were presented to the units who supported the project. The video recording and playback components were retained by the ARI – Fort Benning Research Unit, Fort Benning, GA and could form the foundation for future research.

TRAINING AIDS FOR BASIC COMBAT SKILLS: A VIDEO FEEDBACK SYSTEM

CONTENTS

LIST OF TABLES

CONTENTS (continued)

Page

LIST OF FIGURES

Training Aids for Basic Combat Skills: A Video Feedback System

Introduction

This research report supplements the description of the development of training aids for basic combat skills given in Bink, Wampler, Dlubac, & Cage (2011). The overarching goal of the training aids described in Bink et al. was to develop a set of aids that could be used by Initial Entry Training (IET) companies to assist Soldiers in improving skill proficiency. To this end, training-aid suggestions from approximately 150 Drill Sergeants (DSs) and training company leaders representing more than 25 IET companies were solicited. There were several criteria for selecting the specific types of training aids to develop from these suggestions. First, the training aids should address important basic-combat skills. Second, the training aids should address tasks with which IET Soldiers have difficulty. Third, the training aids should be compact and portable enough to be used in field environments while still being useful in the barracks or a classroom. Finally, the training aids should address the need to tailor training to the background and proficiencies of Soldiers.

As outlined in Bink et al. (2011), training-aid development should follow a five-phase process: Design, Development, Utilization, Assessment, and Revision. Accordingly, a training aid is not fully developed until each phase has been applied to the aid, and these phases should be completed sequentially. The Design phase refers to the preliminary plans regarding the purpose and function of the aid, whereas the Development phase refers to the application of Design principles to the practicality of the training environment and resources available for the training aid (Bink et al., 2011). Stated differently, Design involves preparing the aspects of the aid that will drive its use, whereas Development involves participating in the construction of the aid and planning the practical aspects that might influence that construction. Following Design and Development, Utilization involves the use (physical or mental) of the training aid. Next, Assessment involves the empirical and practical review of the stages that precede it. Principles in the Assessment phase call for the evaluation of whether the aid was effectively utilized in its current design to meet the goals for which it was developed. Finally, Revision involves using the evaluation results to create a more effective and efficient training aid. The present research report details the development, assessment, and revision of a training aid to support performance feedback to Soldiers. More specifically, a video capture and playback system was evaluated for use in individual and collective drills.

Soldiers are adult learners who arrive at IET with a volume of different experiences. They typically have developed habits of thought that could impede their openness to new ideas. However, as volunteers in the Army, they are usually motivated by self-esteem and a desire for achievement. Therefore, if DSs are able to function as a facilitator to pique Soldier motivation, Soldiers are more likely to fall into the learner-centric mode where they take a larger role in their learning (McCombs, 2004). One way to motivate Soldiers is by providing immediate feedback on performance, provided the feedback is presented via a means that facilitates the Soldier's improved comprehension of task performance.

The IET environment creates challenges for DSs that hinder their ability to serve as facilitators. There are more than 100 basic combat tasks[1] to be trained in IET including collective tasks. The vast majority of these are hands-on performance-oriented tasks, such as conducting tactical movement, applying life-saving steps to control bleeding from a wound, and engaging targets with a weapon. While some performance assessment can be accomplished from examining just the end-state results of the task, many tasks require personal observation by the DS in order to provide an adequate assessment. The need for personal assessment is especially true when the desired outcome is not achieved and the DS needs to diagnose the Soldier's shortcomings.

Finally, the Soldier-to-DS ratio is high in the IET training with a single DS often responsible for assessing 60 Soldiers or more during a training event. The situation is exacerbated because DSs have limited time to observe each Soldier and provide performance feedback. To potentially reduce the negative impact of the high Soldier-to-DS ratio, Soldiers can take added responsibility for training through a concept called "SMART Training" (Wilcox & Wickman, 2010). One of the key principles of the SMART Training approach is to maximize the use of peer-to-peer learning and collaboration. Leaders identify and empower Soldiers who have demonstrated skill in a subject area to serve as assistant instructors and coaches. These selected Soldiers could present concurrent training events to other Soldiers in lieu of the DS, which would allow the DSs to focus on a smaller group of Soldiers.

While the SMART Training approach seems to have merit, new Soldiers may not necessarily be skilled enough to ensure other new Soldiers are properly trained. There is at least one means to overcome this issue. Soldiers could view a video of the task being performed so they can see and better learn how to perform the task. These Soldier-trainers could then use the same or similar video to assist in coaching or training other Soldiers. The Soldier-trainers could also use the video as a reference while working with other Soldiers to verify the task is being executed properly. If the DS desires, the Soldier-trainer could capture other trainee performance on video so the DS can view it later to provide a critique and assessment.

The goal of the present research effort was to explore a training aid that would allow DSs to provide immediate feedback to Soldiers as part of their regular training. Ideally, the feedback could be provided at a time and place when Soldiers could make timely adjustments to their performance. This also means that Soldier-trainers should be able to use this capability when serving as assistant trainers and coaches. The idea was to provide video capture and playback capability that could be used by DSs in field environments for easy use during a multitude of training events. Thus, the development of a training aid in this case was not the production of an actual tool but, rather, was the process of defining how to utilize the tool in IET training.

[1] The Soldier's Manual of Common Tasks (Department of the Army, 2006) lists 172 Warrior Skill Level 1 tasks.

Training Aid Design and Development

Desired System Characteristics

An effective training aid must be designed to meet the needs of the intended target audience, in this case the IET DSs, and the desired training outcome, in this case the ability to provide immediate performance feedback to Soldiers. In order for the feedback system to be beneficial, it must include several characteristics of effective military training (e.g., Wampler, Dyer, Livingston, Blankenbeckler, & Dlubac, 2006). To maximize the potential use of the training aid, it would need to be frequently available to DSs even when participating in field training activities. The training aid should be durable to withstand environmental elements such as rain and exposure to dirt. The system needed to be compact enough and with minimal weight so DSs could easily carry it with them. Lastly, the training aid should allow for stand-alone use to preclude the need for other supporting materials. For example, the training aid should include sufficient power without external support.

Utilizing the video system as a training aid was intended to provide the DS flexibility in providing performance feedback. If desired, experienced DSs could arrange, conduct, and record a training task, prior to the training event. The video could then be shown to Soldiers or Soldier-trainers as an example of how the task should be performed. More experienced DSs could conduct and record the event, which would allow lesser trained DSs to avail themselves of the knowledge and experience of more highly capable DSs in that task area. More experienced DSs could use the video to assist with Soldier peer learning. DSs could play the video for a group of Soldiers to observe. More experienced Soldiers could reinforce their own skill by critiquing other Soldiers' performance, and the less experienced Soldiers could still learn from their errors.

The intent was to have a means to capture the details of a Soldier's actual performance and to use that as the basis for providing feedback. First, seeing a visual representation of the actual situation helps bridge the gap between theory and reality; the Soldier could observe himself first-hand, rather than merely relying on the verbal assessment provided by an observer. Secondly, if actual performance actions were captured in a video, it could provide the flexibility to rewind, replay, and even stop the video feedback to discuss specific points. Trainers could better analyze the actual performance from reviewing the video without having to recall the specific actions as they occurred. This capability would allow trainers to more accurately notice performance details, such as blinking, diverting attention, or missing a cue, actions which might otherwise go unnoticed because they routinely occur so quickly. Finally, a video capture system would provide a permanent record of what occurred. The trainer could use the video to provide immediate feedback but could also access and use the video at a later time and place to refresh Soldier skills or to train other Soldiers.

Equipment Components

The VIO Point-of-View (POV) 1.5 video camera (Figure 1) was the central component in this training aid. Detailed specifications of the camera's capabilities are available at the manufacturer's website (http://www.vio-pov.com/) and at Appendix A.

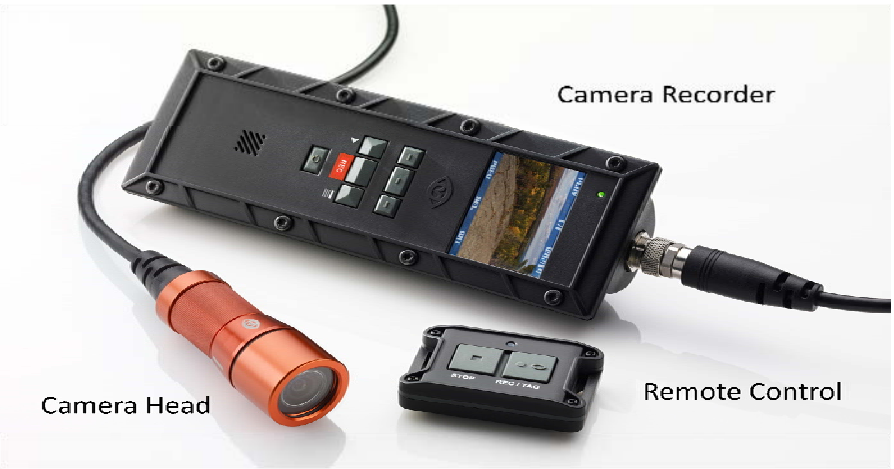

Figure 1. VIO POV 1.5 camera.

The camera recorder was approximately 1.5 in. x 2.5 in. x 6.5 in. and weighed less than one pound, including the 4 AA batteries that power the system. The camera head is approximately 4 in. long, with less than 0.75 in. diameter and weighs a few ounces. A flexible tethering cable approximately 4 feet long connects the recorder to the head. This allows the user to stow the recorder in a pocket or pouch on the lower body while the camera head can easily be placed at various locations around the upper body. Researchers provided a kit with multiple adapters that allowed users to mount the camera to a helmet or other parts of field equipment. The camera could also be used in the hand-held mode.

The camera was equipped with a small built-in viewing screen, approximately 2 in. x 1.5 in. While the screen was adequate for a few personnel to view simultaneously, it limited the ability to show the video to a larger group. For this reason, an Aiptek PocketCinema V10 projector (Figure 2) was also provided as part of the feedback system. Detailed specifications for the projector are available at the manufacturer's website (http://www.aiptek.com/) or at Appendix B.

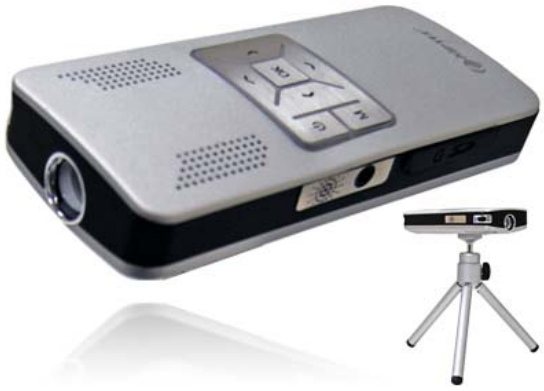

Figure 2. Aiptek PocketCinema V10 projector.

The projector was approximately 5 in. x 2 in. x 1 in. and weighs less than 6 ounces including the rechargeable battery. Power could also be supplied from a standard 110 volt AC outlet. The projector could be mounted on a tripod, placed on a flat surface, or be hand-held.

The camera can be connected directly to the projector so file transfer is not necessary. The projected image is scalable up to 42 in. and can be displayed on a variety of surfaces, even in a field environment.

Training Aid Assessment and Revision

Method

Participants. Seven IET companies participated in the assessment. Two IET companies had the equipment for an entire training cycle of about 10 weeks. During these periods, nine DSs used the feedback system for varying lengths of time and training events. Each of the remaining five IET companies had the equipment for one to five days. A total of 19 DSs used the equipment during these shorter periods.

Procedure. At the start of each assessment period, researchers met with IET company leaders and selected DSs. At that time, cameras and projectors were provided to the company along with suggestions for when and how the components might be beneficial in enhancing Soldier training in basic combat skills. The DSs were encouraged to use the camera and projector as much as possible and to explore different training events and situations that might benefit from the video capture and playback opportunities.

Several possible uses for the equipment were presented to the company leaders and DSs. They could arrange, conduct, and record a training task, prior to the training event. The video could then be shown to Soldiers as an example of how the task should be performed. Experienced DSs could conduct and record the training event which would allow lesser trained DSs to avail themselves of the knowledge and experience of more highly capable DSs in that task area. Another possibility was to use the video cameras during a training event to record actual Soldier performance. This would allow more experienced DSs to provide an on-the-spot assessment and provide feedback to the Soldier while the event was very fresh in his mind. Less experienced DSs could record Soldier performance then allow more experienced DSs to provide the performance assessment feedback to the Soldier. Researchers provided examples of some training events and how the equipment could capture both individual and collective Soldier performance. Yet another use for the equipment would be for more experienced DSs to assist with Soldier peer-learning. The DS could play the video for a group of Soldiers to observe. The more experienced Soldiers could reinforce their own skill by critiquing other Soldier performance and the less experienced Soldiers could still learn from their errors.

Training sessions were conducted to ensure DSs knew how to operate the components of the system. In addition to a demonstration and hands-on practice, each of the four equipment sets included a condensed reference card depicting and explaining the principal functions of each component. More detailed references were provided in the event DSs wanted to explore more advanced options.

For the two companies that used the equipment for the entire 10-week cycle, a researcher met once a week with DSs to capture usage information. DSs completed a questionnaire that

identified the training events for which the equipment was used, the usefulness and difficulty of using the components, and any suggestions for improving the feedback capability. A nine-point Likert-type scale was used to collect responses on each dimension. The questionnaire is provided at Appendix C. A similar questionnaire was completed by DSs at the end of the training cycle. The five companies that used the equipment for single events completed the questionnaires at the end of each day.

Results

Table 1 provides a general layout of the sequence of equipment assessments. The amount of usage is also provided. The two companies who had the equipment for an extended period only used it infrequently and for selected training events. Feedback from the first company indicated that the equipment was more useful during collective training events than during individual training events. Therefore, data collection specifically on collective training events was conducted with five companies over shorter time periods. Hence, the camera usage was higher for the companies who had the equipment for the shorter periods, but those companies did not attempt to use the projector.

Table 1
Sequence and Amount of Equipment Usage

Sequence	Time available	Number of DSs who used system	Number of training events	Number of hours system used	Projector used
Entire Cycle	10 weeks	2	15	56	Yes
Single Event	1 – 5 days	19	4	128	No
Entire Cycle	10 weeks	7	9	86	Yes

Camera Usage. Table 2 lists the training events where the camera was used to record Soldier actions. The specific activities DSs were attempting to capture and assess are also included. For all of the collective training events and three of the individual events, DSs rated the camera between '5' and '9' for usefulness (median = 7). For these events, it appeared that the camera served its intended purpose. Some examples of the events for which the camera was useful included:

- Used recording to critique teams of Soldiers moving as a coordinated group and seeking proper cover for hasty firing positions.
- Able to record and show Soldiers that their back was not arched while executing push-ups or that they failed to lower their body to the required position.
- Captured Soldiers struggling to cross an obstacle in the confidence course and then showed them how to position their body for better leverage.

DSs stated they could show Soldiers their errors, which was more useful than merely trying to explain the errors in words. This capability was especially useful for new Soldiers who did not fully understand how to properly execute a task. Having the video also allowed DSs to review the training activities at a later time and then use that assessment to assist with planning refresher, sustainment, or follow-up training requirements. Figure 3 shows examples of some of the events in which the camera was useful.

Table 2
Selected Training Events and Activities Captured With the Camera

Training Event	Training Activity Captured
Individual Training Events	
Physical Training	Push-ups (proper form and execution)
BRM (5 periods)	Fundamentals of marksmanship (e.g., firing position, trigger control)
ARM (2 periods)	EST 2000 quick fire exercise
First Aid	Buddy team carry, evacuation of wounded personnel
Confidence Course	Negotiating obstacles
US Weapons	Firing positions for machine guns and antitank weapon
Hand Grenades	Throwing form and cover/concealment while approaching a bunker
Collective Training Events	
BTT	Buddy team movement, react to enemy contact, hasty firing positions
FTT	Commands, movement and firing positions during live fire course
STT	Movement as a coordinated unit during battle drills
MOUT	Movement along a street and entering a building (room)
FTX (3 periods)	Various situational training exercises and battle drills

Note: BRM = Basic Rifle Marksmanship, ARM = Advanced Rifle Marksmanship, EST = Engagement Skills Trainer, BTT = Buddy Team Tactical Training, FTT = Fire Team Tactical Training, STT = Squad Tactical Training, MOUT = Military Operations in Urban Terrain, FTX = Field Training Exercise.

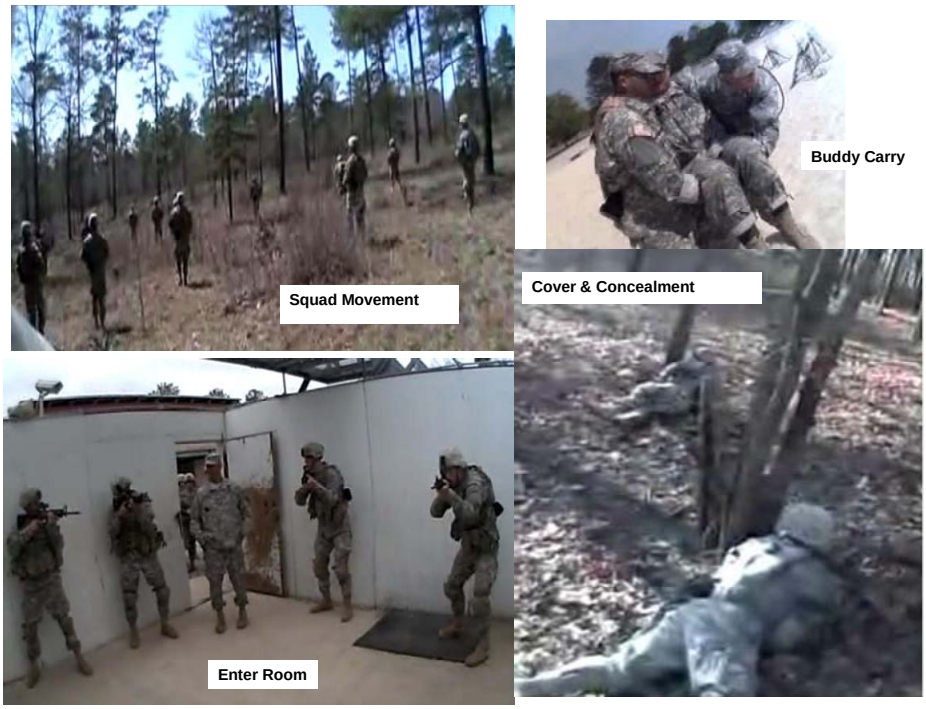

Figure 3. Training activities where camera was useful.

However, the camera was not very useful for recording some of the desired activities during individual training events. For four of the individual training events, DS rated the usefulness of the camera between 1 and 3 (median = 3). Some of the reasons the camera was not useful included:

- During BRM periods, could not capture the details necessary to assess some marksmanship fundamentals such as breath control while aiming, blinking the eye when firing, or following through when squeezing the trigger.
- Some tasks, such as clearing a weapon, were executed so quickly that the camera could not record where Soldier was looking due to obstruction from helmet.
- The low-light conditions inside the EST 2000 precluded capturing a viewable image.

The camera shortcomings noted by the DSs included an inability to zoom-in to see close-up details, no means to playback the video in slow motion, and the requirement for an adequate light source to capture a viewable image. Additionally, the camera viewing screen was small so Soldiers could not see the full details the DSs attempted to capture. Figure 4 shows examples of some of the activities for which the cameras were not useful.

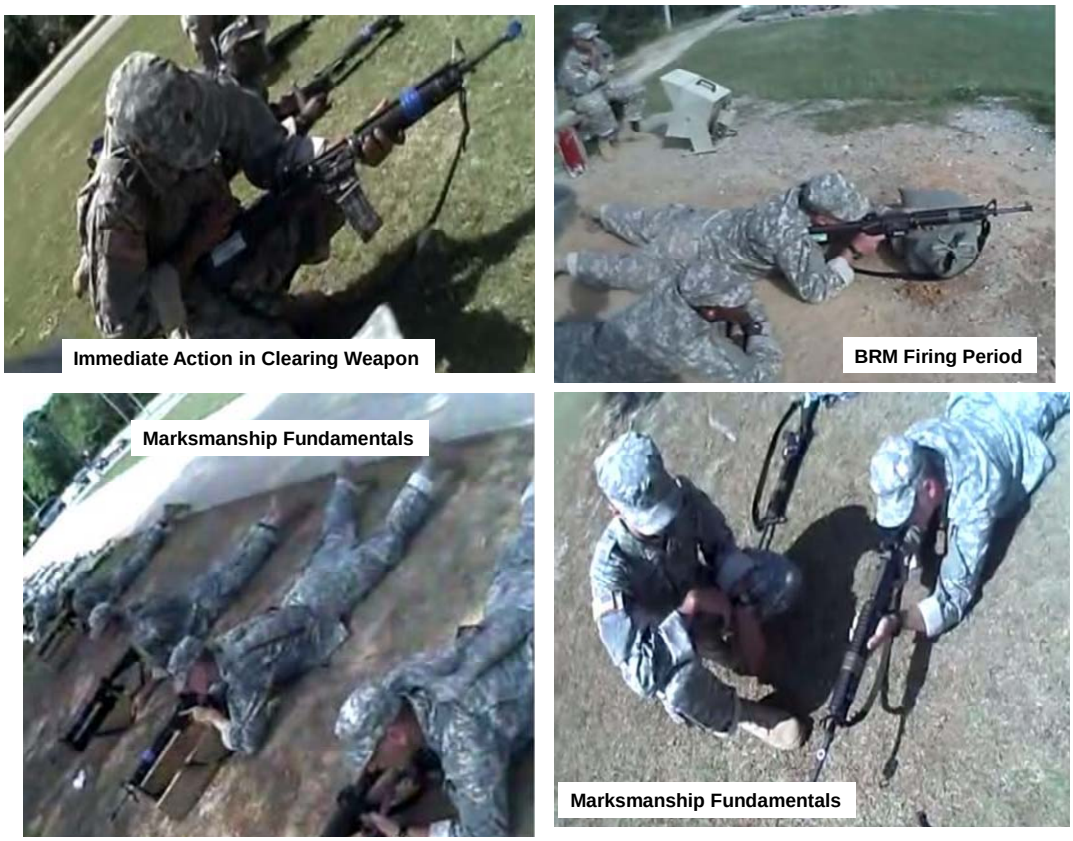

Figure 4. Training activities where camera did not fulfill intended purpose.

Projector Usage. The DSs from all companies reported very limited use of the projector. There were only four training events where the projector was used. In every case, the projector was used in the unit barracks several hours after the training event, not for immediate feedback at the training site. Users stated that the rapid tempo of most training events allowed little or no

time for DSs to provide performance feedback. Some DSs used the small display screen on the camera to show Soldiers the video with their errors while at the training site, but none attempted to use the projector for this purpose. Just as with the camera, DSs used the scale of 1 to 9 (1 = not useful to 9 = very useful) to rate the usefulness of the projector. For those who used the projector, ratings varied from 6 to 9 (median = 7.5).

Ease of Equipment Use. In addition to assessing the usefulness of the components, DSs provided feedback on the ease of use of the camera and projector. On a scale of 1 (not difficult) to 9 (very difficult), DSs consistently rated both the camera and projector as 1 or 2 (median = 1.5). Both components were simple to use with intuitive control buttons and functions. Comments from the users included:

- Easy to mount camera; strong magnetic attachment system; lots of options for mounting
- Controls are user friendly (camera and projector)
- Small, compact, light weight (camera and projector)
- The record and playback on the camera were "dummy proof"

Desired Revisions to Training Aid Capability

Even though most feedback on the equipment components was positive, DSs identified some changes that would improve the usefulness of the video capture and playback training aid. The recommended changes included:

- Improve audio capability. The current camera was equipped with a microphone which was located on the cable connecting the camera head to the camera recorder. This microphone generally captured the voice of the person carrying the camera, provided the microphone was not covered (e.g., by clothing). However, the microphone did not capture voices of Soldiers and leaders as they were conducting movement or located more than a few feet from the camera.
- Add a better carrying option for the camera recorder. The camera recorder can be carried in a clothing pocket or in a pouch attached to a belt. When the camera recorder is carried in either fashion, the user does not have immediate access to camera controls and has limited functionality with the remote control device. Users suggested providing a clip-type device or holder for the camera recorder, similar to the devices used for cell phones.
- Provide a stable mount for the camera. While the camera can be attached to most any objects and is designed for mobile use, DSs also suggested the option of a tripod mount so the camera could be used to record activities from a fixed location and avoid the movement induced by being hand-carried or mounted to a moving person.
- Increase brightness of projector image. The projector provided a good viewable image in locations with reduced lighting. However, in field training locations the image could not be seen very well.
- Provide a zoom-in option for the camera so users can capture details of activities without being immediately adjacent to or in the way of the Soldier while he is performing the training activity.
- Include the capability to record training events in low-light conditions, such as inside the EST 2000 or MOUT facilities.
- In order to show pinpoint actions, provide the capability to playback the recording in slow motion, and to step forward in the video frame at a time.

Discussion and Conclusion

Providing immediate feedback on performance is an important learning mechanism regardless of a Soldier's skill level (Ericsson, Krampe, & Tesch-Romer, 1993). Video feedback of performance can be used to motivate Soldiers and can be used as a formative assessment. Moreover, video capture and playback can serve as a tool to help alleviate the impact of high Soldier-to-DS ratios by providing feedback to groups of Soldiers and by allowing Soldier-trainers to perform some training functions. For these reasons, this research effort sought to define some of the ways in which a given video-capture-and-playback system could be utilized as an IET training aid.

The training aid assessment yielded mixed results for the feasibility of using video feedback in IET. On the one hand, recording a single Soldier performing a task required one-on-one interaction with a DS and the camera in order to provide recording and feedback. This meant the DS was not able to observe and assist the remaining Soldiers during this period. If the IET training environment moves to the SMART training concept (Wilcox & Wickman, 2010), the issue of having supervision and assistance for other Soldiers will be partially alleviated. Some of the intricate details of task performance, such as a Soldier blinking or jerking when firing a weapon, were difficult to capture and view with the recording. DSs suggested that recording collective task performance provided potentially higher pay-off because the DS could observe a larger group of Soldiers simultaneously and could provide feedback to the group. Also, larger group tasks were not as focused on minute, split-second details as was the case with weapons firing. Furthermore, while the camera was adequate to record training events, DSs stated there was not ample time in the IET training schedule to use the feedback capability (i.e., the projector or the viewer on the camera) to provide feedback to individual Soldiers. When attempted, the projector image generally was not clearly visible in field conditions so it was only used effectively indoors.

On the other hand, DSs reported that the most useful situation for the camera to record activities was while conducting operations in an urban environment. The DS could capture a small team of Soldiers performing various tasks and provide immediate feedback so each Soldier could see his error and make corrections before continuing with further training practice. The small group of Soldiers, generally no more than four, could view the camera screen and could see sufficient detail to understand the critique from the DS. The projector was not used for feedback, but rather was used to present training material to Soldiers at an indoor location that explained and showed how to execute a collective task prior to practicing the event in a field environment.

The camera component generally satisfied most criteria for the DSs in the IET training environment (e.g., small, light weight, durable and usable in field conditions, simple to operate). It provided an easy-to-use device to capture training activities, but not the finite details of some individual, rapidly-performed tasks. However, due to the high Soldier-to-DS ratio and fast-paced training schedule, there is very limited opportunity for the DSs to use the recorded material to provide feedback to Soldiers.

The projector did not function well in a field environment because it required an area with reduced lighting in order to view the image. Because the preponderance of IET training events occur in field locations, and are conducted in a time-constrained situation, DSs stated that providing immediate feedback at the training site was not a viable option, even if they had a projector that worked well in those conditions.

At the end of the assessment period an IET unit retained the camera and projector. They used the equipment to record experienced DSs conducting training events and explaining how to train selected IET tasks. The unit used these recordings to construct training materials that will be used to train lesser experienced DSs and can also be used to present training to Soldiers, if desired. The projector was used to present the training materials to large groups. As a result, it appeared that the video system was useful for capturing video to develop into training materials and projecting the resulting material to train a group of personnel.

While providing feedback on training performance contributes to learning, the video capture and playback system did not meet all of the needs of an IET training environment. The current situation of a large ratio of Soldiers to trainers and limited available time preclude DSs from presenting any detailed immediate feedback to Soldiers during field training on a routine basis. These constraints do not necessarily mean a video-feedback system could not be valuable to IET training. Rather, the effective employment of video feedback must be structured so that it does not require too much additional effort for DSs as they execute training. Using cameras in fixed positions, having one DS dedicated to capturing video, or utilizing Soldier-trainers to capture video are all approaches that make the use of video feedback more efficient. Likewise, different equipment may be required to achieve the purpose of the video-feedback system. For example, a handheld video camera and a laptop might be more useful than the mounted camera and miniature projector to capture video and quickly provide feedback. In sum, the lessons learned for the present research effort can help guide further development of video-feedback approaches.

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Acronyms

ARM	Advanced Rifle Marksmanship
BRM	Basic Rifle Marksmanship
BTT	Buddy Team Tactical Training
DS	Drill Sergeant
EST	Engagement Skills Trainer
FTT	Fire Team Tactical Training
FTX	Field Training Exercise
IET	Initial Entry Training
MOUT	Military Operations in Urban Terrain
POV	Point-of-view
STT	Squad Tactical Training

APPENDIX A

POV 1.5 CAMERA HARDWARE SPECIFICATIONS

POV 1.5 Camera Hardware Specifications

VIDEO	
Frame Rates	30fps, 25fps, 24fps, 15fps
Resolutions	720x480, 720x400, 640x480, 360x240, 360x200, 320x240
Formats	MPEG4 AVI (digital), NTSC/PAL (analog)
Exposure Control	Automatic exposure control and white balance
IMAGING HARDWARE	
Processor	32-bit MIPS microprocessor, 12-bit image
Sensor	advanced CMOS sensor with electronic global shutter
Type	1/3” CMOS
Pixel size	6um (H) x 6um(V)
Diagonal	5.35 mm
Resolution	Total pixel count: VGA (752x480), active pixel count: VGA
Dynamic Range	75-110 dB
Sensitivity	5 lux color sensor
Image Capture Mode	Video
Exposure	Auto control
AE Metering Setting	Auto (center-weighted)
White Balance	Auto control
ISO Speed Setting	Auto (default)
Color Setting	Full color (default)
OPTICS	
Sensitivity	F/#2.0
Optical Filter	Wih IR glass
Aperture	F/2.0
Effective Focal length	2.97mm
Focusing range	40cm~
Diagonal Field of View	110 degrees
View Finder	No

IMAGE DISPLAY - AUTO	
Size	2 inch
Type	LTPS LCD
Resolution	640 x 240 dots (153k)
Color arrangement	RGB Delta
Color Number	Full color
Brightness	360 cd/m2
Image Rotate Sensor	No
AUDIO	
Mic Type	Monaural omni-directional cable-mounted -40 dB sensitivity at 1 kHz
Resolution	16-bit half-duplex
Sampling Rate	32 kHz
SNR (Signal to Noise Ratio)	80 dB
Speaker	Monaural 8 ohm Mylar, 0.7W max
MEMORY	
RAM	64MB
Internal Memory	16MB NAND Flash
External Picture Storage	Secure Digital (SDHC) Card, supports up to 8G
Image storage priority	SDHC Card
DATA HANDLING	
Recording Capacity	8 gigabytes maximum on SDHC Card
File Functions	Record, Playback, Delete
I/O Ports	SDHC card slot, USB 2.0 high-speed (mini-b), Mic In, NTSC/PAL Analog, TV/Audio Out (live stream capable)
USER INTERFACE	
Navigation Controls	All on recording unit including click mode select keys for Recording, Playback, and Setup modes
Auxiliary Controls	Unidirectional RF remote control with Record, Tag, and Stop controls
Functionality	Record, Tagging, file navigation (including Select, Playback, and Delete); recording configurable for Clip Capture or Loop mode. User configurable camera settings via Settings menu screens

SIZE & MASS	
Recording Unit	40mm x 60mm x 167mm, 328 grams (with 4 AA batteries)
Imaging Head	
Remote Control	24 grams with A27 battery
LVDS Tether Cable	Approx. 1.5 meters long
POWER	
Battery Type	4 x AA Batteries (alkaline, Ni-MH, or photo lithium)
Battery Life	4-5 hours with alkaline batteries, up to 10 hours with lithium batteries. Battery life depends on POV settings and operating conditions.
Recharge Circuit	No
DC-in	No
REGULATORY	
Safety	CE/FCC
EMC	CE, BSMI
Green Environment	RoHS compliant
Manual Version	v1.5 10.02.08

APPENDIX B

AIPTEK POCKETCINEMA V10 PRODUCT OVERVIEW

Aiptek PocketCinema V10 Product Overview

Key Features

- Innovative handheld-size projector for projecting image on various surfaces in dark rooms!
- LCoS optical technology developed by 3M.
- Projects image size up to 42" at over 5 feet away.
- LED light source for durable use.
- Projects image from iPod, digital cameras, camcorders, mobile phones, and game consoles w/ AV-Out.
- Supports JPEG, video, and MP3.
- A handy tool for personal entertainment and small group meetings.

Specifications

Display Technology	LCoS (Liquid Crystal on Silicon)
Light Source	White LED
Luminous Flux	10 Lumens
Projection Resolution	640 x 480 Pixels (VGA)
Aspect Ratio	4 : 3
Projection Image Size (Diagonal)	6" - 42" (15cm - 127cm)
Projection Distance	8" - 70" (21cm - 180cm)
Zoom & Focus	Manual
Playback File Format	
Photo	JPEG
Video	MPEG-4 (Non DIVX-AVI, .ASF, .MP4), H.264 through Arc Soft Media Converter conversion to MJPEG- AVI or MJPEG .ASF for device playback
Audio	MP3
AV Interface	3-in-1 AV phone jack
Audio	Stereo, 0.5W
Internal Memory	1GB
External Memory	SD / SDHC / MMC / MS Pro up to 32GB **(Not Included)**

Remote Control	Included
Dimensions	4.9" x 2.1" x 0.9"
Weight	5.2 oz. (without battery)

System Requirements

Microsoft Windows 2000, XP, Vista
Pentium III - 800MHz or above
50 MB Free Hard Drive Space for Program Installation
256 MB RAM (512 MB DDR RAM Recommended)
16-bit Color Display at 800 x 600 or above (32 MB video Memory w/ DirectX 3D Support Recommended)
DirectX 9.0c or above
Windows Media Player 9 or above
QuickTime 6.5 or above
RealPlayer 8 or above

APPENDIX C

VIDEO PLAYBACK ASSESSMENT QUESTIONNAIRE

Video Playback Assessment Questionnaire

1. During what training events held this week did you use the camera and/or projector? What was the intent – what did you hope to accomplish with this use? (Exactly how did you use each item and how did it work? Was the camera used in a handheld mode or mounted in some method?)

Event
_____

Event
_____

Event
_____

Event
_____

2. During these training event(s), when was the camera most useful? Why?

3. During these training event(s), when was the projector most useful? Why?

4. In retrospect, were there some events during this week where you would have liked to use the video playback but did not? Why? What "lessons learned" did you experience that would be helpful for future usage?

5. About how long did the fully charged batteries last for the camera_____ projector_____?

6. For each event where the camera/projector was used, ask them to provide a rating.

a. For event_____

On a scale of 1 – 9, how <u>useful</u> was the camera? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not useful Very useful

On a scale of 1 – 9, how difficult was the camera to use? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not difficult Very difficult

On a scale of 1 – 9, did the video capture/playback help your Soldiers learn? Why? Why not? What could have been done to make it better?

1 2 3 4 5 6 7 8 9
Helped very little Helped a lot

b. For event _____

On a scale of 1 – 9, how useful was the camera? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not useful Very useful

On a scale of 1 – 9, how difficult was the camera to use? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not difficult Very difficult

On a scale of 1 – 9, did the video capture/playback help your Soldiers learn? Why? Why not? What could have been done to make it better?

1 2 3 4 5 6 7 8 9
Helped very little Helped a lot

c. For event_____

On a scale of 1 – 9, how useful was the camera? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not useful Very useful

On a scale of 1 – 9, how difficult was the camera to use? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not difficult Very difficult

On a scale of 1 – 9, did the video capture/playback help your Soldiers learn? Why? Why not? What could have been done to make it better?

1 2 3 4 5 6 7 8 9
Helped very little Helped a lot

d. For event _____

On a scale of 1 – 9, how <u>useful</u> was the camera? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not useful Very useful

On a scale of 1 – 9, how <u>difficult</u> was the camera to use? Projector? Why? (put "P" and "C" on scale)

1 2 3 4 5 6 7 8 9
Not difficult Very difficult

On a scale of 1 – 9, did the video capture/playback help your Soldiers learn? Why? Why not? What could have been done to make it better?

1 2 3 4 5 6 7 8 9
Helped very little Helped a lot